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ABSTRACT

This report details the findings of a study conducted to assess area employer manpower needs and job entry requirements for biomedical equipment technicians. Fifty usable responses to a survey were obtained, 20 from biomedical equipment technicians and 30 from employers. Results of the survey indicated that job vacancies did exist in the area, although few in number. Future needs were also ascertained. Respondents indicated what they felt were "essential," "very important," "desirable," "not important," or "not applicable" qualifications of biomedical equipment technicians. Certification was rated as desirable but not mandatory by employers. Since the survey results indicated that the area market for biomedical equipment technicians might become quickly saturated were an appropriate career program implemented, alternatives were recommended, including: making such a program an adjunct of the regular electronics program, restricting admission to the program, placement of each student in an on-the-job training site as part of the two-year program, and incorporation in the curriculum of those skills rated as essential by over 50% of the respondents. Tables of survey data are included in the report, and the survey instruments are appended. (JDS)

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PREFACE

The initial planning for a biomedical equipment technician program began in 1975. The electronics staff contacted individuals known to work as biomedical technicians and some area businesses who employed such individuals. Based on these contacts, the staff members compiled a list of skills which they felt should be considered in the curriculum development.

The Engineering and Technology Division of the Instructional Branch then requested the Office of Institutional Research to assist it in conducting an area manpower survey. The survey was designed to assess local manpower needs, obtain employer perceptions of the skills needed to secure employment in the field, and to identify possible on-the-job training sites for students. Mr. Carl Lindsey and Mr. Bill Studyvin, members of the Engineering and Technology Division, identified the population to be surveyed and the content of the survey instrument. Mr. Michael Quanty coordinated the preparation of the printed questionnaires, the follow-up of respondents, the data analyses, and contributed to the preparation of this written report. Mrs. Connie Ritchie helped prepare the data summaries.

Elaine L. Tatham
Director of Institutional Research

TABLE OF CONTENTS

Page

PREFACE 1

TABLE OF CONTENTS ii

I. INTRODUCTION 1

II. METHODOLOGY 2

III. RESPONDENTS 2

IV. AREA MANPOWER NEEDS 3

Current Job Openings 3
Future Openings 3

V. PERCEPTIONS OF IMPORTANT SKILLS NEEDED BY GRADUATES OF A BIOMEDICAL EQUIPMENT TECHNICIAN PROGRAM 3

Essential Qualifications 4
Essential or Very Important Qualifications 5
Essential, Very Important or Desirable Qualifications . 6
Certification 7
Basis for Hiring 7
Acquisition of Job Entry Skills and Knowledge 8
Training Programs - Current and Future 8

VI. DISCUSSION 8

VII. SUMMARY AND RECOMMENDATIONS 10

Implementation of Program 10
Recommendations 13

REFERENCE 14

TABLES 15

APPENDIX. Survey Instruments with Tabulated Raw Data 24

EMPLOYER MANPOWER NEEDS AND JOB ENTRY REQUIREMENTS FOR BIOMEDICAL EQUIPMENT TECHNICIAN

I. INTRODUCTION

As new methods have been discovered for the diagnosis and treatment of illnesses, there also has been a rapid increase in the biomedical equipment used in hospitals, laboratories, clinics and other medical facilities. These health agencies are just beginning to need technicians to inspect, repair and calibrate their biomedical equipment. In the past, equipment manufacturers or outside maintenance businesses serviced an institution's equipment.

The number of biomedical equipment technicians certified by the Association for the Advancement of Medical Instrumentation (AAMI) or the Institute for the Certification of Engineering Technicians (ICET) is very limited. There are only about 200 in the country certified by AAMI (The Shreveport Times, 1975). As more of these technicians become trained and available to work, it is probable that health agencies will hire their own technicians rather than depend upon outside agencies for equipment maintenance.

The Engineering and Technology Division at JCCC requested that the research staff assist it in developing and conducting a survey of area employers who use biomedical equipment and of employees in the area known to inspect, repair or calibrate biomedical equipment. The purpose was to assess current needs for technicians and the skills and knowledge required for their placement. In addition, the surveyed employers were asked whether they would be willing to cooperate with JCCC in an on-the-job training program for biomedical equipment technicians.

II. METHODOLOGY

Copies of the two questionnaires developed for this survey are included in the Appendix. One form was sent to 78 employers who were thought to use biomedical equipment. A second form was sent to 31 persons known to inspect, repair or calibrate biomedical equipment. The majority of the employers and employees were in the metropolitan Kansas City area. However, some were in other areas of Kansas and Missouri as well as Nebraska and Illinois.

After approximately three weeks, the response rate was considered too low to allow for any meaningful analyses of the data. As a result, all non-respondents in the greater Kansas City area were contacted by telephone and urged to respond. A second copy of the questionnaire was sent to all those who were willing to participate in the survey.

III. RESPONDENTS

Twenty persons employed to do the work of a biomedical technician responded. Eighteen of these 20 technicians were employed in the greater Kansas City area, one in Topeka, Kansas, and the other in Columbia, Missouri. These 20 technicians were employed by 14 different employers. One area hospital employed three of the 20 respondents.

Thirty-five employers responded. Five of the 35 responding employers did not hire anyone to do the work of a biomedical equipment technician. They either contracted out the services or handled very little or no medical supplies or equipment. Their responses were not included in the data analyses. Of the remaining 30 employers, 26 were located in the greater Kansas City area: two in St. Louis, Missouri; one in Omaha, Nebraska; and one in Morton Grove, Illinois.

The data presented in this report are based on the responding 20

technicians and the 30 employers who did hire persons with some of the skills listed in the questionnaire.

IV. AREA MANPOWER NEEDS

Current Job Openings

Eighteen of the 30 employers had no unfilled vacancies which required the skills listed on the first three pages of the survey instrument. The remaining twelve had a total of 18 vacancies. Ten employers had one vacancy, one had two vacancies and one had six vacancies. The employer with six openings and one of the employers with one opening were outside the greater Kansas City area. Thus, there were 11 known vacancies with 10 employers within the local metropolitan area.

Both the employer with two vacancies and the employer with six vacancies responded that they would hire, at this time, applicants possessing the listed skills. Nine of the ten employers with one vacancy responded that they would hire at this time. As the other employer with one vacancy also responded that there were plans to establish a position requiring those skills, that employer apparently is in the process of implementing such a position but was not actually ready to hire someone.

Future Openings

Nineteen of the 30 employers responded that they had current plans to establish a position requiring the indicated skills or to expand the current number of positions requiring the indicated skills. Included among these 19 were the employer with six vacancies, the employer with two vacancies and nine of the employers with one vacancy. Thus, there were eight other employers expressing future needs but no current needs.

V. PERCEPTIONS OF IMPORTANT SKILLS NEEDED BY GRADUATES OF A BIOMEDICAL EQUIPMENT TECHNICIAN PROGRAM

The respondents rated each characteristic as either "essential,"

"very important," "desirable," "not important," or "not applicable." For each characteristic, the number of technicians and employers assigning each rating is displayed on the respective survey instrument in the Appendix. The table beginning on page 15 summarizes these data in terms of percentages. Since the responses of the employers and technicians were very similar, only the combined responses (N=50) will be presented in the section which follows.

Essential Qualifications

Thirteen characteristics were rated "essential" by more than 50 percent of the 50 respondents. These qualifications together with the percentage of respondents rating the skill as "essential" are as follows:

- Perform spot and routine safety checks on equipment including ground and leakage current checks (86%).
- Read and interpret instructional and maintenance manuals as well as blue prints, mechanical drawings, and schematic diagrams related to the equipment serviced (84%).
- Use common hand tools such as needlenose pliers, diagonal cutters and screwdrivers in the performance of job tasks (82%).
- Solder standard electrical and electronic components on printed circuit boards and hand wired circuits (70%).
- Operate test equipment such as high and low frequency signal generators; low frequency, dual channel, and high frequency oscilloscopes; sweep generators; universal bridges; strip charts and X-Y recorders (70%).
- Measure electrical parameters such as sinusoidal waveforms, frequency, bandwidth, gain, attenuation, phase, period, and inductive and capacitive reactance using standard test equipment (64%).
- Make good judgments regarding repair techniques best suited to any given problem (64%).
- Effectively coordinate work with the work of others who are working as a team (63%).
- Possess a working knowledge of a cardiac monitor's operation (68%), preventive maintenance (64%), and repair (60%).

- Possess a working knowledge of EKG equipment's operation (68%), preventive maintenance (62%), and repair (60%).
- Possess a working knowledge of a defibrillator's operation (68%), preventive maintenance (62%), and repair (58%).
- Possess a working knowledge of a monitor alarm system's operation (62%), preventive maintenance (58%), and repair (54%).
- Meet high quality standards of neatness and accuracy (55%).

Essential or Very Important Qualifications

When the percentage of respondents who rated a characteristic as "very important" was added to the percentage of respondents who rated the same characteristic as "essential," the need for a graduate to have the 13 characteristics listed above becomes even more obvious. Three of the characteristics are almost mandatory. The same 13 characteristics are presented below with the combined percentage of respondents who rated the characteristic as "essential" or "very important."

- Use common hand tools such as needlenose pliers, diagonal cutters and screwdrivers in the performance of job tasks (98%).
- Read and interpret instructional and maintenance manuals as well as blue prints, mechanical drawings, and schematic diagrams related to the equipment serviced (96%).
- Perform spot and routine safety checks on equipment, including ground and leakage current checks (94%).
- Measure electrical parameters such as sinusoidal waveforms, frequency, bandwidth, gain, attenuation, phase, period, and inductive and capacitive reactions using standard test equipment (90%).
- Meet high quality standards of neatness and accuracy (90%).
- Solder standard electrical and electronic components on printed circuit boards and hand wired circuits (88%).
- Operate test equipment such as high and low frequency signal generators; low frequency, dual channel, and high frequency oscilloscopes; sweep generators; universal bridges; strip charts and X-Y recorders (86%).
- Make good judgments regarding repair techniques best suited to any given problem (86%).

- Effectively coordinate work with the work of others who are working as a team (86%).

- Possess a working knowledge of a cardiac monitor's operation (80%), preventive maintenance (82%), and repair (74%).

- Possess a working knowledge of EKG equipment's operation (78%), preventive maintenance (84%), and repair (74%).

- Possess a working knowledge of defibrillator's operation (78%), preventive maintenance (82%), and repair (72%).

- Possess a working knowledge of a monitor alarm system's operation (78%), preventive maintenance (80%), and repair (72%).

There were nine other characteristics rated as either "essential" or "very important" by more than 50 percent of the respondents. They are presented below.

- Meet deadlines consistently (90%).

- Communicate with and provide technical assistance to medical staff using standard medical terminology related to instrumentation (80%).

- Predict potential equipment problems (72%).

- Evaluate medical instrumentation and advise medical staff on the relative merits of potential acquisitions (60%).

- Clean and/or lubricate mechanical instruments and devices associated with medical apparatus (58%).

- Research and review technical reports (56%).

- Possess a working knowledge of a respirator's operation (56%) and preventive maintenance (56%).

- Possess a working knowledge of a blood-gas analyzer's operation (52%) and preventive maintenance (58%).

- Possess a working knowledge of a spectrophotometer's operation (50%) and preventive maintenance (52%).

Essential, Very Important or Desirable Qualifications

When the percentage of respondents rating a characteristic as "desirable" was added to the percentage of those who rated the same characteristic as "essential" or "very important," the resulting percentage was at least

70 percent for each of the 31 skills listed in the survey instrument.

Every one (100%) of the 50 respondents rated the following seven characteristics as important:

- Read and interpret instructional and maintenance manuals as well as blue prints, mechanical drawings, and schematic diagrams related to the equipment serviced.
- Use common hand tools such as needlenose pliers, diagonal cutters and screwdrivers in the performance of job tasks.
- Effectively coordinate work with the work of others who are working as a team.
- Make good judgments regarding repair techniques best suited to any given problem.
- Predict potential equipment problems.
- Meet high quality standards of neatness and accuracy.
- Meet deadlines consistently.

Certification

Five of the 20 responding technicians were certified. Three of the five were certified by AAMI, one by ICET and one by the Veterans Administration.

Three of the 30 responding employers cited certification as a desirable but not mandatory characteristic.

Basis for Hiring

The question which requested the respondent to indicate the basis for hiring permitted two responses. Thus, the numbers cited below add to more than the number of respondents.

Forty-five percent (N=9) of the 20 technicians stated they were hired on the basis of displayed competencies, five percent (N=1) on the basis of degree and 35 percent (N=7) on basis of both degree and displayed competencies. Thirty-five percent (N=7) listed other criteria such as experience, references, ability to get along with others and computer skills as factors which influenced their being hired.

Forty percent (N=12) of the 30 employers responded that they hired on the basis of displayed competencies, three percent (N=1) on the basis of degree and 33 percent (N=10) on the basis of both degree and displayed competencies. Twenty-three percent (N=7) listed other criteria such as experience, written test, references and personal qualities as factors which influence hiring.

Acquisition of Job Entry Skills and Knowledge

Sixty percent (N=12) of the 20 technicians stated they acquired their job entry skills and knowledge through a combination of formal education and on-the-job training. Thirty percent (N=6) stated that only formal education was the basis for acquiring these skills while ten percent (N=2) stated that only on-the-job training was the basis.

Thirty percent (N=6) of the 20 technicians responded that they had participated in a work-study program designed to provide on-the-job training in a medical field.

Training Programs - Current and Future

Forty percent (N=12) of the 30 employers responded that they currently had an in-service training program involving instruction in some of the skills listed on the questionnaire.

Sixty-seven percent (N=20) of the employers indicated that they would be willing to work cooperatively with JCCC in a college supervised work-study program for qualified students.

All 20 of the technicians and 80 percent (N=24) of the 30 employers responded that the College could contact them in the future regarding the program.

VI. DISCUSSION

It should be noted that, on the basis of the survey responses, staff do appear to be planning the appropriate content for a bio-medical

technician program. Every skill included on the survey instrument was considered "essential," "very important" or "desirable" by at least 70 percent of the 50 respondents.

In addition, the technicians and the employers did give very similar ratings to most of the skills listed in the questionnaire. However, the written comments of technicians differed in one important respect from those of the employers. The individuals working as technicians tended to express that they felt a great need in the area for a program to train biomedical equipment technicians. The employers did not tend to make such comments. Yet, a high percentage of companies did indicate they would be willing to cooperate with JCCC in a work-study program. Their hesitancy in encouraging the College to train technicians may reflect their unfamiliarity with this relatively new field.

The questionnaire was sent to almost every employer in the metropolitan area with a likelihood of employing someone to do the work of a biomedical equipment technician. Nevertheless, on the basis of the responses, there appear to be only 11 openings in the metropolitan Kansas City area. Representatives of another eight area employers did indicate that they had plans to establish a position. The employer expressing the greatest need for biomedical equipment technicians was outside the Kansas City area. Thus, a major concern in establishing a biomedical equipment technician career program is that the local market for graduates may become saturated very quickly.

There are alternatives to ameliorate this concern. The JCCC staff could implement a plan to inform and convince potential area employers of the advantages to be gained by hiring a person trained as a biomedical equipment technician. A well-designed cooperative work-study program

with a very limited enrollment that would culminate in the graduation and successful placement of all students could be one component of such a plan. However, graduates should be aware that they might have to seek employment outside the Kansas City metropolitan area.

Another alternative could be to develop a bio-medical equipment technician program which, at least initially, would be an adjunct to the regular electronics program. Participants could take basic courses including electronics and medical terminology. The specialization could be obtained through a work-study arrangement. For example, one employer expressed a great need for persons trained to service X-ray equipment. Thus, the work-study situations could be quite diverse both with respect to specialization and type of employer. As the employers become informed and the number of vacancies increases, the need for a program to train biomedical equipment technicians will intensify. Until then, though, the training costs per student will be high if very much specialized equipment is purchased.

VII. SUMMARY AND RECOMMENDATIONS

The Instructional Branch has been exploring the feasibility of implementing a career program for biomedical equipment technicians. As one component of the resultant study, questionnaires were sent to businesses thought to use biomedical equipment and to persons known to inspect, repair or calibrate biomedical equipment. Complete responses were obtained from 30 businesses and 20 technicians in time for inclusion in this report.

Implementation of Program

The responses concerning current and future job openings did result in a concern which should be given consideration before JCCC implements a career program for biomedical equipment technicians. The number of persons

working as biomedical equipment technicians and the number of businesses that hire such persons are both quite small. There were 18 identified vacancies with 12 employers but seven of these vacancies were outside the greater Kansas City area. There were eight other employers who responded they might need technicians in the future but not at the present time.

Any students entering a biomedical equipment technician program could not graduate until 1978. By then, these known vacancies will undoubtedly be filled. So any decision to implement a career program must be accompanied by a plan of action to identify vacancies and educate area businesses concerning the advantages to them of a trained individual.

In addition, should a final decision be made to begin a biomedical equipment technician program, the enrollment should be limited to about six or eight students. Certainly, no more students should be accepted than can be placed in on-the-job training sites. With such a restriction, the program might initially be an adjunct to the regular electronics program.

Each of the skills listed on the survey instrument was rated as "essential," "very important" or "desirable" by at least 70 percent of the respondents. Thus, the instructional staff at JCCC had identified skills considered important by employers and technicians. Every one (100%) of the respondents rated the following seven characteristics as "essential," "important" or "desirable."

- Read and interpret instructional and maintenance manuals as well as blue prints, mechanical drawings, and schematic diagrams related to the equipment serviced.
- Use common hand tools such as needlenose pliers, diagonal cutters and screwdrivers in the performance of job tasks.
- Effectively coordinate work with the work of others who are working as a team.
- Make good judgments regarding repair techniques best suited to any given problem.

- Predict potential equipment problems.
- Meet high quality standards of neatness and accuracy.
- Meet deadlines consistently.

There were thirteen characteristics considered as "essential" by over 50 percent of the 50 respondents. When the percentage rating these 13 characteristics as "very important" was added to the percentage rating them "essential," the resulting percentages were all at least 72 percent. These 13 characteristics are listed below together with the percentage rating them "essential" or "very important."

- Use common hand tools such as needlenose pliers, diagonal cutters and screwdrivers in the performance of job tasks (98%).
- Read and interpret instructional and maintenance manuals as well as blue prints, mechanical drawings, and schematic diagrams related to the equipment serviced (96%).
- Perform spot and routine safety checks on equipment including ground and leakage current checks (94%).
- Measure electrical parameters such as sinusoidal waveforms, frequency, bandwidth, gain, attenuation, phase, period, and inductive and capacitive reactance using standard test equipment (90%).
- Meet high quality standards of neatness and accuracy (90%).
- Solder standard electrical and electronic components on printed circuit boards and hand wired circuits (88%).
- Operate test equipment such as high and low frequency signal generators; low frequency, dual channel, and high frequency oscilloscopes; sweep generators; universal bridges; strip charts and X-Y recorders (86%).
- Make good judgments regarding repair techniques best suited to any given problem (86%).
- Effectively coordinate work with the work of others who are working as a team (86%).
- Possess a working knowledge of a cardiac monitor's operation (80%), preventive maintenance (82%), and repair (74%).
- Possess a working knowledge of EKG equipment's operation (78%), preventive maintenance (84%), and repair (74%).

- Possess a working knowledge of a defibrillator's operation (78%), preventive maintenance (82%), and repair (72%).
- Possess a working knowledge of a monitor alarm system's operation (78%), preventive maintenance (80%), and repair (72%).

Recommendations

With the job market currently being rather limited, plans for a career program for biomedical equipment technicians should be correspondingly limited. However, such plans also should be capable of incorporating future changes very likely to occur. In view of the data and comments from the survey respondents, the following recommendations are made.

Recommendation 1: That the program be established only if the initial investment needed for equipment is minimal.

Recommendation 2: That the program initially begin as an adjunct to an existing career program such as the regular electronics program.

Recommendation 3: That the number of students be limited to six or eight students for the first few years.

Recommendation 4: That only those students evidencing a high likelihood of completing the program and obtaining employment be admitted.

Recommendation 5: That a plan of action be developed to educate area businesses concerning the advantages of hiring an individual trained as a biomedical equipment technician.

Recommendation 6: That the curriculum incorporate those 13 skills rated as "essential" by over 50 percent of the respondents.

Recommendation 7: That students become aware of the important roles that communication and personal characteristics play in a work situation.

Recommendation 8: That each student be placed in an on-the-job training site for a portion of the two-year program.

REFERENCE

Engineer's Keep Things Humming, The Shreveport Times, October 30, 1975.

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT
SKILLS, KNOWLEDGE AND ATTITUDES FOR
BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976

Skill to be Acquired:	Essential	Very Important	Desirable	Not Important	Not Applicable
Measure electrical parameters such as sinosoidual waveforms, frequency, bandwidth, gain, attenuation, phase, period, and inductive and capacitive reactance using standard test					
Technician	70%	25%	5%	0%	0%
Employer	60	27	10	0	3
Combined	64	26	8	0	2
Perform simple operations on machine tools (e.g., lathes, mills, drill presses, bench grinders, and hand drills)					
Technician	15	25	30	25	5
Employer	10	3	57	27	3
Combined	12	12	46	26	4
Operate test equipment such as high and low frequency signal generators; low frequency, dual channel, and high frequency oscilloscopes; sweep generators; universal bridges; strip charts and X-Y recorders					
Technician	80	20	0	0	0
Employer	64	13	20	0	3
Combined	70	16	12	0	2
Lay out and fabricate electronic devices that include cabinet layout and printed circuit board wiring or chassis wiring					
Technician	0	25	70	0	5
Employer	7	13	60	13	7
Combined	4	18	64	8	6
Read and interpret instructional and maintenance manuals as well as blue prints, mechanical drawings, and schematic diagrams related to the equipment serviced					
Technician	95	5	0	0	0
Employer	77	16	7	0	0
Combined	84	12	4	0	0

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT SKILLS, KNOWLEDGE AND ATTITUDES FOR BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976
(continued)

Skill to be Acquired:	Essential	Very Important	Desirable	Not Important	Not Applicable
Communicate with and provide technical assistance to medical staff using standard medical terminology related to instrumentation					
Technician	50%	40%	10%	0%	0%
Employer	47	27	20	6	0
Combined	48	32	16	4	0
Clean and/or lubricate mechanical instruments and devices associated with medical apparatus					
Technician	35	35	30	0	0
Employer	40	10	43	7	0
Combined	38	20	38	4	0
Solder standard electrical and electronic components on printed circuit boards and hand wired circuits					
Technician	70	25	5	0	0
Employer	70	13	13	0	4
Combined	70	18	10	0	2
Use common hand tools such as needlenose pliers, diagonal cutters and screw drivers in the performance of job tasks					
Technician	95	5	0	0	0
Employer	73	23	4	0	0
Combined	82	16	2	0	0
Evaluate medical instrumentation and advise medical staff on the relative merits of potential acquisitions					
Technician	30	25	35	10	0
Employer	33	30	24	10	3
Combined	32	28	28	10	2
Collect and analyze data obtained from analog, special purpose, and standard digital computers					
Technician	10	5	60	25	0
Employer	10	14	60	6	10
Combined	10	10	60	14	6

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT
SKILLS, KNOWLEDGE AND ATTITUDES FOR
BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976
(continued)

Skill to be Acquired:	Essential	Very Important	Desirable	Not Important	Not Applicable
Develop digital systems that include counters, digital to analog converters as well as circuits for interfacing medical instrumentation to standard and special purpose digital computers					
Technician	5%	5%	60%	20%	10%
Employer	0	7	67	13	13
Combined	2	6	64	16	12
Develop special electronic circuits and instrumentation as required by medical or engineering staff					
Technician	5	25	50	15	5
Employer	0	17	56	17	10
Combined	2	20	54	16	8
Prepare tables, charts, and graphs for technicial reports and communications					
Technician	30	10	45	10	5
Employer	13	20	50	10	7
Combined	20	16	48	10	6
Perform spot and routine safety checks on equipment including ground and leakage current checks					
Technician	95	5	0	0	0
Employer	80	10	3	3	4
Combined	86	8	2	2	2

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT
SKILLS, KNOWLEDGE AND ATTITUDES FOR
BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976
(continued)

Possess a Working Knowledge of:	Essential	Very Important	Desirable	Not Important	Not Applicable
Blood-gas analyzer					
Operation					
Technician	50%	15%	35%	0%	0%
Employer	40	3	40	0	17
Combined	44	8	38	0	10
Preventive Maintenance					
Technician	50	20	30	0	0
Employer	44	6	37	0	13
Combined	46	12	34	0	8
Repair					
Technician	55	5	40	0	0
Employer	34	6	47	0	13
Combined	42	6	44	0	8
Cardiac Monitor					
Operation					
Technician	85	5	10	0	0
Employer	56	17	20	0	7
Combined	68	12	16	0	4
Preventive Maintenance					
Technician	80	10	10	0	0
Employer	53	23	17	0	7
Combined	64	18	14	0	4
Repair					
Technician	85	5	10	0	0
Employer	43	20	30	0	7
Combined	60	14	22	0	4
EKG Equipment					
Operation					
Technician	85	5	10	0	0
Employer	56	13	24	0	7
Combined	68	10	18	0	4

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT
SKILLS, KNOWLEDGE AND ATTITUDES FOR
BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976
(continued)

Possess a Working Knowledge of:	Essential	Very Important	Desirable	Not Important	Not Applicable
EKG Equipment (continued)					
Preventive Maintenance					
Technician	80%	10%	10%	0%	0%
Employer	50	30	13	0	7
Combined	62	22	12	0	4
Repair					
Technician	85	5	10	0	0
Employer	43	20	30	0	7
Combined	60	14	22	0	4
Defibrillator					
Operation					
Technician	85	5	10	0	0
Employer	56	13	24	0	7
Combined	68	10	18	0	4
Preventive Maintenance					
Technician	80	10	10	0	0
Employer	50	26	17	0	7
Combined	62	20	14	0	4
Repair					
Technician	85	5	10	0	0
Employer	40	20	33	0	7
Combined	58	14	24	0	4
Monitor Alarm Systems					
Operation					
Technician	85	5	10	0	0
Employer	47	23	20	0	10
Combined	62	16	16	0	6
Preventive Maintenance					
Technician	80	10	10	0	0
Employer	43	30	17	0	10
Combined	58	22	14	0	6
Repair					
Technician	75	15	10	0	0
Employer	40	20	30	0	10
Combined	54	18	22	0	6

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT
SKILLS, KNOWLEDGE AND ATTITUDES FOR
BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976
(continued)

Possess a Working Knowledge of:	Essential	Very Important	Desirable	Not Important	Not Applicable
Respirators					
Operation					
Technician	50%	15%	35%	0%	0%
Employer	40	10	30	0	20
Combined	44	12	32	0	12
Preventive Maintenance					
Technician	45	15	40	0	0
Employer	36	17	27	0	20
Combined	40	16	32	0	12
Repair					
Technician	45	15	40	0	0
Employer	27	10	43	0	20
Combined	34	12	42	0	12
Infant Incubators					
Operation					
Technician	55	10	25	0	10
Employer	33	14	36	0	17
Combined	42	12	32	0	14
Preventive Maintenance					
Technician	55	10	25	0	10
Employer	30	23	33	0	14
Combined	40	18	30	0	12
Repair					
Technician	55	10	25	0	10
Employer	20	16	50	0	14
Combined	34	14	40	0	12
Spectrophotometer					
Operation					
Technician	35	30	35	0	0
Employer	30	10	43	3	14
Combined	32	18	40	2	8

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT
SKILLS, KNOWLEDGE AND ATTITUDES FOR
BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976
(continued)

Possess a Working Knowledge of:	Essential	Very Important	Desirable	Not Important	Not Applicable
Spectrophotometer (continued)					
Preventive Maintenance					
Technician	30%	35%	30%	0%	5%
Employer	27	17	46	0	10
Combined	28	24	40	0	8
Repair					
Technician	25	40	35	0	0
Employer	17	14	53	6	10
Combined	20	24	46	4	6
X-Ray Equipment					
Operation					
Technician	35	10	40	10	5
Employer	27	10	43	3	17
Combined	30	10	42	6	12
Preventive Maintenance					
Technician	25	10	45	10	10
Employer	17	26	40	3	14
Combined	20	20	42	6	12
Repair					
Technician	20	10	50	10	10
Employer	14	16	43	14	13
Combined	16	14	46	12	12
Communication Systems					
Operation					
Technician	45	10	25	5	15
Employer	20	20	36	10	14
Combined	30	16	32	8	14
Preventive Maintenance					
Technician	35	15	30	5	15
Employer	14	33	33	10	10
Combined	22	26	32	8	12

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT
SKILLS, KNOWLEDGE AND ATTITUDES FOR
BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976
(continued)

Possess a Working Knowledge of:	Essential	Very Important	Desirable	Not Important	Not Applicable
Communication Systems (continued)					
Repair					
Technician	40%	5%	35%	5%	15%
Employer	10	23	43	14	10
Combined	22	16	40	10	12
Other (e.g., Polygraphs, dental equipment, etc.)					
Operation					
Technician	50	19	31	0	0
Employer	29	6	36	29	0
Combined	40	12	33	15	0
Preventive Maintenance					
Technician	57	7	36	0	0
Employer	12	12	41	35	0
Combined	32	10	39	19	0
Repair					
Technician	57	7	36	0	0
Employer	6	59	0	35	0
Combined	29	3	49	19	0

EMPLOYER AND TECHNICIAN PERCEPTIONS OF IMPORTANT
SKILLS, KNOWLEDGE AND ATTITUDES FOR
BIOMEDICAL EQUIPMENT TECHNICIANS
Spring 1976
(continued)

Knowledge of and Ability to:	Essential	Very Important	Desirable	Not Important	Not Applicable
Effectively coordinate work with the work of others who are working as a team					
Technician	80%	15%	5%	0%	0%
Employer	52	29	19	0	0
Combined	63	23	14	0	0
Research and review technical reports					
Technician	40	30	20	10	0
Employer	27	20	43	10	0
Combined	32	24	34	10	0
Make good judgments regarding repair techniques best suited to any given problem					
Technician	65	20	15	0	0
Employer	63	24	13	0	0
Combined	64	22	14	0	0
Predict potential equipment problems					
Technician	30	40	30	0	0
Employer	40	33	27	0	0
Combined	36	36	28	0	0
Meet high quality standards of neatness and accuracy					
Technician	50	40	10	0	0
Employer	58	32	10	0	0
Combined	55	35	10	0	0
Meet deadlines consistently					
Technician	55	30	15	0	0
Employer	43	50	7	0	0
Combined	48	42	10	0	0

APPENDIX

SURVEY INSTRUMENTS
with
TABULATED RAW DATA

JOHNSON COUNTY COMMUNITY COLLEGE
BIOMEDICAL EQUIPMENT
TECHNICIAN TASK SURVEY
1976

Johnson County Community College is conducting a study to determine the qualifications needed by graduates of a Biomedical Equipment Technician program in the metropolitan Kansas City area. You are one of the few businesses which utilizes biomedical equipment Therefore, your responses are very important to the success of this study. This information will remain confidential and will not obligate you in any way. If you have any questions, call Mr. Bill Studyvin between 8:00 and 5:00 Monday through Friday at 888-8500 (ext. 589).

Name Employers' Responses Position _____

Company N=35, five not applicable, so excluded from summary Address _____

City _____ State _____ Zip _____

INSTRUCTIONS:

Listed below are skills which may be considered in development of the curriculum. These skills would be expected of all graduates. How important are they to you, as an employer? Check one answer for each statement and write any additional comments in the space provided.

	Essential	Very Important	Desirable	Not Important	Not Applicable
Measure electrical parameters such as sinosoidual waveforms, frequency, bandwidth, gain, attenuation, phase, period, and inductive and capacitive reactance using standard test equipment	18	8	3	0	1
Perform simple operations on machine tools (e.g. lathes, mills, drill presses, bench grinders, and hand drills)	3	1	17	8	1
Operate test equipment such as high and low frequency signal generators; low frequency, dual channel, and high frequency oscilloscopes; sweep generators; universal bridges; strip charts and X-Y recorders	19	4	6	0	1
Lay out and fabricate electronic devices that include cabinet layout and printed circuit board wiring or chassis wiring	2	4	18	4	2
Read and interpret instructional and maintenance manuals as well as blue prints, mechanical drawings, and schematic diagrams related to the equipment serviced	23	5	2	0	0
Communicate with and provide technical assistance to medical staff using standard medical terminology related to instrumentation	14	8	6	2	0
Clean and/or lubricate mechanical instruments and devices associated with medical apparatus	12	3	13	2	0
Solder standard electrical and electronic components on printed circuit boards and hand wired circuits	21	4	4	0	1

KNOWLEDGE AND ABILITY TO:	Essential	Very Important	Desirable	Not Important	Not Applicable
Use common hand tools such as needlenose pliers, diagonal cutters and screw drivers in the performance of job tasks	22	7	1	0	0
Evaluate medical instrumentation and advise medical staff on the relative merits of potential acquisitions	10	9	7	3	1
Collect and analyze data obtained from analog, special purpose, and standard digital computers	3	4	18	2	3
Develop digital systems that include counters, digital to analog converters as well as circuits for interfacing medical instrumentation to standard and special purpose digital computers	0	2	20	4	4
Develop special electronic circuits and instrumentation as required by medical or engineering staff	0	5	17	5	3
Prepare tables, charts, and graphs for technical reports and communications	4	6	15	3	2
Perform spot and routine safety checks on equipment including ground and leakage current checks	24	3	1	1	1
POSSESS A WORKING KNOWLDEGE OF:					
Blood-gas analyzer					
Operation	12	1	12	0	5
Preventive Maintenance	13	2	11	0	4
Repair	10	2	14	0	4
Cardiac Monitor					
Operation	17	5	6	0	2
Preventive Maintenance	16	7	5	0	2
Repair	13	6	9	0	2
EKG Equipment					
Operation	17	4	7	0	2
Preventive Maintenance	15	8	5	0	2
Repair	13	6	9	0	2
Defibrillator					
Operation	17	4	7	0	2
Preventive Maintenance	15	8	5	0	2
Repair	12	6	10	0	2
Monitor Alarm systems					
Operation	14	7	6	0	3
Preventive Maintenance	13	9	5	0	3
Repair	12	6	9	0	3

POSSESS A WORKING KNOWLEDGE OF:	Essential	Very Important	Desirable	Not Important	Not Applicable
Respirators					
Operation	12	3	9	0	6
Preventive Maintenance	11	5	8	0	6
Repair	8	3	13	0	6
Infant Incubators					
Operation	10	4	11	0	5
Preventive Maintenance	9	7	10	0	4
Repair	6	5	15	0	4
Spectrophotometer					
Operation	9	3	13	1	4
Preventive Maintenance	8	5	14	0	3
Repair	5	4	16	2	3
POSSESS A WORKING KNOWLEDGE OF:					
X-Ray Equipment					
Operation	8	3	13	1	5
Preventive Maintenance	5	8	12	1	4
Repair	4	5	13	4	4
Communication Systems					
Operation	6	6	11	3	4
Preventive Maintenance	4	10	10	3	3
Repair	3	7	13	4	3
Other (e.g., Polygraphs, dental equipment, etc.)					
Please specify _____					
Operation	5	1	6	5	0
Preventive Maintenance	2	2	7	6	0
Repair	1	10	0	6	0
POSSESS THE ABILITY TO:					
Effectively coordinate work with the work of others who are working as a team	16	9	6	0	0
Research and review technical reports	8	6	13	3	0
Make good judgments regarding repair techniques best suited to any given problem	19	7	4	0	0
Predict potential equipment problems	12	10	8	0	0
Meet high quality standards of neatness and accuracy	18	10	3	0	0
Meet deadlines consistently	13	15	2	0	0

Please list other skills that are necessary or desirable.

_____

_____

_____

How many persons requiring one or more of the skills listed do you employ on a full-time basis? _____

How many persons requiring one or more of the skills listed do you employ on a part-time basis? _____

Are there other qualifications or characteristics required of your employees (education, experience, certification, etc.?) Please list.

_____

_____

_____

Do you hire on the basis of:

12 Displayed Compentencies
1 Degree
10 Both
7 Other (please specify) _____

How many unfilled vacancies do you currently have requiring the skills listed on the first three pages of this questionnaire? _____

If you had applicants possessing these listed skills, would you hire them at this time? 12 Yes; 18 No

Do you have any current plans to establish a position requiring the skills indicated or to expand the current number of positions requiring the skills indicated? 19 Yes; 11 No/blank

Do you currently have an in-service training program involving instruction in any of the skills listed? 12 Yes; 18 No/blank

Would you be willing to work cooperatively with a college supervised work-study program designed to provide on-the-job training for qualified students? 20 Yes; 10 No/blank

May we contact you in the future regarding this program? 24 Yes, 6 No/blank
If yes, phone number _____

Additional comments: _____

_____

_____

_____

Please return the questionnaire in the enclosed self-addressed stamped envelope.

WE WOULD APPRECIATE IT VERY MUCH IF THE SURVEY COULD BE RETURNED TO US WITHIN TWO WEEKS.

Bill Studyvin
Johnson County Community College
College Blvd. at Quivira Road
Overland Park, KS 66210

32

JOHNSON COUNTY COMMUNITY COLLEGE
BIOMEDICAL EQUIPMENT
TECHNICIAN TASK SURVEY
1976

Johnson County Community College is conducting a study to determine the qualifications needed by graduates of a Biomedical Equipment Technician program in the metropolitan Kansas City area. You are one of the few technicians who workswith biomedical equipment. Therefore, your responses are very important to the success of this study. This information will remain confidential and will not obligate you in any way. If you have any questions, call Mr. Bill Studyvin between 8:00 and 5:00 Monday through Friday at 888-8500 (ext. 589).

Name Technicians' Responses Position _____

Company N=20 Address _____

City _____ State _____ Zip _____

INSTRUCTIONS:

Listed below are skills which may be considered in development of the curriculum. These skills would be expected of all graduates. How important are they to you, as an employee? Check one answer for each statement and write any additional comments in the space provided.

	Essential	Very Important	Desirable	Not Important	Not Applicable
Measure electrical parameters such as sinosoidual waveforms, frequency, bandwidth, gain, attenuation, phase, period, and inductive and capacitive reactance using standard test equipment.....	14	5	1	0	0
Perform simple operations on machine tools (e.g. lathes, mills, drill presses, bench grinders, and hand drills).....	3	5	6	5	1
Operate test equipment such as high and low frequency signal generators; low frequency, dual channel, and high frequency oscilloscopes; sweep generators; universal bridges; strip charts and X-Y recorders.....	16	4	0	0	0
Lay out and fabricate electronic devices that include cabinet layout and printed circuit board wiring or chassis wiring.....	0	5	14	0	1
Read and interpret instructional and maintenance manuals as well as blue prints, mechanical drawings, and schematic diagrams related to the equipment serviced.....	19	1	0	0	0
Communicate with and provide technical assistance to medical staff using standard medical terminology related to instrumentation.....	10	8	2	0	0
Clean and/or lubricate mechanical instruments and devices associated with medical apparatus.....	7	7	6	0	0
Solder standard electrical and electronic components on printed circuit boards and hand wired circuits.....	14	5	1	0	0

IN YOUR JOB, HOW IMPORTANT IS IT THAT YOU HAVE THE KNOWLEDGE AND ABILITY TO:	Essential	Very Important	Desirable	Not Important	Not Applicable
Use common hand tools such as needlenose pliers, diagonal cutters and screw drivers in the performance of job tasks	19	1	0	0	0
Evaluate medical instrumentation and advise medical staff on the relative merits of potential acquisitions	6	5	7	2	0
Collect and analyze data obtained from analog, special purpose, and standard digital computers	2	1	12	5	0
Develop digital systems that include counters, digital to analog converters as well as circuits for interfacing medical instrumentation to standard and special purpose digital computers	1	1	12	4	2
Develop special electronic circuits and instrumentation as required by medical or engineering staff	1	5	10	3	1
Prepare tables, charts, and graphs for technical reports and communications	6	2	9	2	1
Perform spot and routine safety checks on equipment including ground and leakage current checks	19	1	0	0	0
HOW IMPORTANT IS IT THAT YOU POSSESS A WORKING KNOWLEDGE OF:					
Blood-gas analyzer					
Operation	10	3	7	0	0
Preventive Maintenance	10	4	6	0	0
Repair	11	1	8	0	0
Cardiac Monitor					
Operation	17	1	2	0	0
Preventive Maintenance	16	2	2	0	0
Repair	17	1	2	0	0
EKG Equipment					
Operation	17	1	2	0	0
Preventive Maintenance	16	2	2	0	0
Repair	17	1	2	0	0
Defibrillator					
Operation	17	1	2	0	0
Preventive Maintenance	16	2	2	0	0
Repair	17	1	2	0	0
Monitor Alarm systems					
Operation	17	1	2	0	0
Preventive Maintenance	16	2	2	0	0
Repair	15	3	2	0	0

HOW IMPORTANT IS IT THAT YOU POSSESS A WORKING KNOWLEDGE OF:	Essential	Very Important	Desirable	Not Important	Not Applicable
Respirators					
Operation	10	3	7	0	0
Preventive Maintenance	9	3	8	0	0
Repair	9	3	8	0	0
Infant Incubators					
Operation	11	2	5	0	2
Preventive Maintenance	11	2	5	0	2
Repair	11	2	5	0	2
Spectrophotometer					
Operation	7	6	7	0	0
Preventive Maintenance	6	7	6	0	1
Repair	5	8	7	0	0
HOW IMPORTANT IS IT THAT YOU POSSESS A WORKING KNOWLEDGE OF:					
X-Ray Equipment					
Operation	7	2	8	2	1
Preventive Maintenance	5	2	9	2	2
Repair	4	2	10	2	2
Communication Systems					
Operation	9	2	5	1	3
Preventive Maintenance	7	3	6	1	3
Repair	8	1	7	1	3
Other (e.g., Polygraphs, dental equipment, etc.) Please specify _____					
Operation	8	3	5	0	0
Preventive Maintenance	8	1	5	0	0
Repair	8	1	5	0	0
HOW IMPORTANT IS IT THAT YOU BE ABLE TO DO THE FOLLOWING IN YOUR JOB:					
Effectively coordinate work with the work of others who are working as a team	16	3	1	0	0
Research and review technical reports	8	6	4	2	0
Make good judgments regarding repair techniques best suited to any given problem	13	4	3	0	0
Predict potential equipment problems	6	8	6	0	0
Meet high quality standards of neatness and accuracy	10	8	2	0	0
Meet deadlines consistently	11	6	3	0	0

Please list other skills that are necessary or desirable.

Are you certified? 5 Yes If so, by whom

Are there other qualifications or characteristics required of you (education, experience, etc.?) Please list.

Were you hired on the basis of:

9 Displayed Compentencies
1 Degree
7 Both
7 Other (please specify)

Did you acquire your job entry skills/knowledge through formal education 18 or on-the-job training? 14

Did you participate in a work-study program designed to provide on-the-job training in the medical field? 6 Yes

May we contact you in the future regarding this program? 20 Yes

Additional comments:

Please return the questionnaire in the enclosed self-addressed stamped envelope.

WE WOULD APPRECIATE IT VERY MUCH IF THE SURVEY COULD BE RETURNED TO US WITHIN TWO WEEKS.

Bill Studyvin
Johnson County Community College
College Blvd. at Quivira Road
Overland Park, KS 66210

UNIVERSITY OF CALIF.
LOS ANGELES

SEP 24 1976

CLEARINGHOUSE FOR
JUNIOR COLLEGES